Data to the diet of the urban Stone marten (*Martes foina* Erxleben) in Budapest

By

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Abstract. Stone marten (*Martes foina* Erxleben) seems to be one of the most successful, adaptable mammal. All the studies, dealing with the feeding ecology of this marten, emphasize and verify the fact that it is an omnivorous, euriphagous, opportunistic predator species of the family Mustelidae. Within its huge biogeographical area it found its rule in the food chain of urban environment, too. The frequency and biomass of different items are miscellaneous, according to sources of environment, but the quantity of the urban garbage is insignificant, against its high abundance and easy availability.

The present study took into consideration numerous previous studies (e.g. Delibes, 1978; Lucherini & Crema, 1993; Lanszki, 1994; Pandolfi, De Marinis & Petrov, 1996; Doncaster, Dickman & MacDonald, 1990). Abundance, availability and dispersion of food resources determine the food habits of carnivores (e.g. MacDonald, 1981; Doncaster et al. 1990; Cavallini & Lovari, 1991). But we have only a few data about the diet of the urban Stone marten, just like the exploitable resources of urban environment. Important factors are: presence of men, lock or low number of competitors, predators and richness of food and hiding-places. The „parameters" of urban populations are unknown, but it is sure that a meeting with this acrobatic animals are frequent all over the town. Their presence becomes evident causing different economic damage, or by stealing eggs, eating bunnies, chickens, plucking the nests of song-birds and causing terrible noise, nasty odor in the often used dens, so they viewed as pests.

The aim of this study was to analyze the 87 collected faeces samples to get data on the diversity of the food and feeding behavior of Stone marten inhabiting Budapest. Conclusions are on the basis of identified food items and using the registrations of citizenry I have been collecting through two years (08. 1996 – 08. 1998). As far as I know there were no similar studies in Hungary.

Sampling area and methods

The 87 faeces samples were collected at the same time, from a garret of a family house, in a socalled „green district" of Budapest, in April 1998. The family houses and gardens are

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in good conditions there. There are a lot of old fruit-trees, pines, thugs, ornamental shrubbery's. Little outbuildings, undisturbed attics important hiding places. The den hadused continuously through two years by 1–4 Stone martens, probably a female and her cubs. The garret was surely only one of the nocturnal resting sites inside of the territories of this family. Some studies described that *Martes* species use a lot of resting sites within their territory in natural environment (e.g. Zalewski, 1997). The territory of Stone martens in their natural environment is about 350-400 ha, that mean an approximate density of 0.7 individuals/100 ha (Serafini & Lovari, 1993). The territories of males are twice as big as those of females (Seknack, 1990). My sampling place probably is on the edge of the territory of martens using this garret, because to the East extend are densely populated areas and a very busy thoroughfare, and runs the Danube as North-South barrier. Human surroundings offer high density of food and dens, so the territory of urban martens shrink and their density may grow. Calculating about 100 ha territory, these martens prowl often hills of Buda.

Summarizing the data about the sampling place, the diversity of vegetation, the high number of possible hiding places, the closeness of forestry hills and parks mean an ideal habitat for the Stone martens.

The different aged faeces well represented the yearly diet, but didn't allow to analyze the season dependent changes. Samples must had been soaked in 60% alcohol to loosen its content so preparing them for washing. Each samples was washed under tap water through a bolting work, using sieves taking under each other with 2.8, 2.5, 2.0, 1.0, 0.7 mm mesh. Then all the selected samples were oven dried. The scat analysis followed mainly the methodology described by Goszczynski (1974), Delibes (1978), Kruuk & Parish (1981), Holisova & Obrtel (1982), Serafini & Lovari (1993). 25 random samples were counted to express the number of occurrence (N. occ.), the percent frequency of occurrence (% freq. occ.: as number of occurrence of each food/number of faeces × 100), percentage of occurrence (number of occurrence of each food/total number of occurrences × 100). Dry weight of main items was given, too.

The indigestible remnants were examined under microscope. The hairs were identified by my own reference collection. The other items were identified using taxonomic key-books.

Results and discussion

Previous studies show the high and locally changing diversity of the diet composition, the low level of urbanization, important rule as top-predator of vertebrates of urban Stone martens (Holisova & Obrtel, 1981; Lucherini & Crema, 1993). My results prove a generalist predator, as in other studies. Supposing that martens had used this garret all over the two years and that the contents of faeces are from surrounding urban environment, the results reflect the diversity of sampling area, too.

After washing the 87 samples through the sieves, percentage of dry weight of items were plant: 50.48%, feather: 6.18%, bone: 5.51%, hair: 3.33%, insect: 2.82%, mixture: 31.68%, on the basis of first selection. The so called „Mixture" category contain all the other remnants, including unidentified materials. The large biomass of easy selectable and definable items (62.7 % dry weight) were on the sieve with 2.8 mm mesh, while the so called „Mixture" category proved to be very informative, were on the sieve with 1.0 mm mesh (18.6%). Selected and identified items of mixture category contributed to the results, so the „Other" category as food item means only the garbage and stones (Fig. 1).

According to standard methods the results were expressed in the number of occurrences, percent frequency of occurrence as well as percentage of occurrence (Table 1).

Plants

The most important items were the different vegetable parts. The pulpy fruits mean the dominant mass, reflected in the high number of occurrence of their seeds (22), and percentage of occurrence (37.3). The most frequent were plums (*Prunus*), mulberries (*Morus*), grapes (*Vitis*), hips (*Rosa*) which probably were consumed in summer and autumn. Seeds and leaves of *Thuja* species, and little percent of needles of pines, grasses, seeds of sunflower (*Helianthus annuus*), pieces of barks and a seed of clematis (*Clematis vitalba*) take the dry parts of plants and were probably consumed in winter or mixture with other times. The small quantity but relative frequent occurrence of other seeds of monocotyledonous plants perhaps derive from consumed pouches, e.g. the seeds of wheat (*Tritium*), millet *(Panicum*) and unidentified grasses. Stone martens should be spread some seeds.

Vertebrates

Birds become the most dominant item among vertebrates, the percentage of tgheir occurrence (16.6) is twice as big as mammal items (8.8). The unidentified samples consisted of broken fragments of bones, floccuses and underhairs, claws, parts of feet.

There were three faeces samples containing only hairs with skin and some bones of mammals and five samples only feathers and bones, feet of birds in it. All the other samples had vegetative parts, too. The hair analysis shows very interesting results. In the 87 samples the more frequent mammals were *Apodemus sylvaticus* (13), *Mus musculus* (4), *Sciurus vulgaris* (3), *Glis glis* (2), *Rattus norvegicus* (1), and an unidentified bat species (1). One faeces contained human hairs, derive of course from a garbage. These results show that Stone martens hunt at least three level, on the ground, on the stem and in the leafage, and prefer the den-living preys. The samples contain their own hairs, too, derive from making toilet, playing each other, etc. There were guard hairs of cats in two faeces. I have information that stone martens kill the house cats or their cubs, and the stray cats disappear from martens' territory. Probably these hairs derive from a fight of them. Cats and martens would become competitors for the same vertebrate food-supply and dens in urban environment.

Birds were mostly Passeriformes species and *Turdus*. There were little parts of white and blue egg-shells, intact feet. In case of easy accessibility, Stone martens often stole chickens and eggs. Eggs often stored in their dens (Morimando, 1996), as I found in some cases, too. Perhaps the white egg-shells were of domesticated birds. While the biomass of vertebrate food mainly consists of birds, the diversity of it is lower than mammal items.

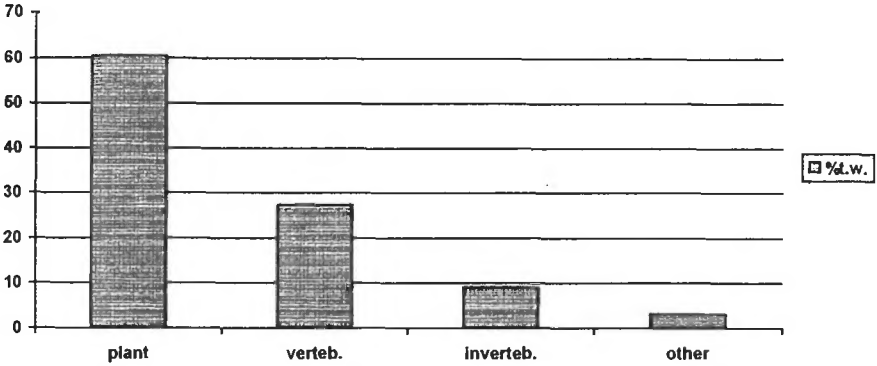

Fig. 1. Dry weight of selected 87 samples

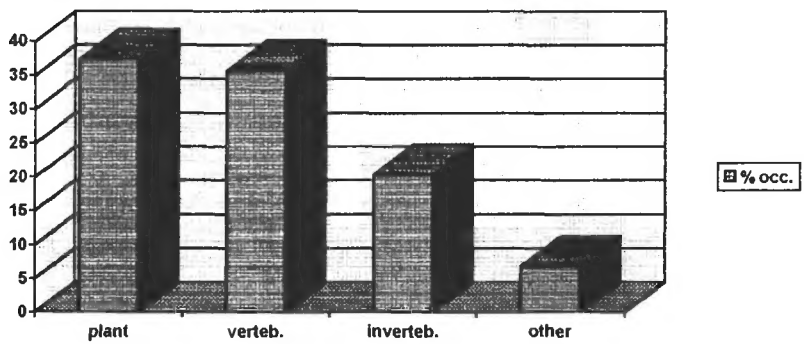

Fig. 2. Percentage of occurrence (in the 25 analyzed samples)

Invertebrates

The invertebrates mean the third fundamental food item. This study did not analyzed the presence of earthworms, but comparing with previous studies, Stone marten consume only low mass of invertebrates, including earthworms (Holisova & Obrtel, 1981). There were wings, legs, chitin fragments, total inhurt insects and a lot of unidentifiable, little parts of arthropods. The samples form three categories. The first category and largest biomass were those ones living probably in the faeces. Its number of occurrence were 2–20 : *Ptirus* spp. and ants (*Formica*) were the most frequent, then *Stegobium* sp., *Ptirus* larvae and unidentified larvae of Coleoptera in totally uninjured state. Important to mention that there were none living insects in the samples, perhaps they were eaten by chance but undigestibled? Other studies are needed to solve this question. The second category consisted of those probably eaten by chance with other food, the number of its occurrence only 1–3: *Otiorhynchus rugosostriatus* (frequent in grapes and berries), *Melanotus* sp., *Harpa-*

Table 1. 25 faeces were analized individually to get standard data (% t.w. : percentage of dry weight of the 87 samples)

Food items	N.occ.	%freq.occ.	%occ.	% t.w.
Plants	22	88	37.3	60.5
1. seeds of fruits	16	64	16.6	
2. seeds of others	13	52	13.5	
3. dry parts of plants	11	44	11.4	
4. unindentified	5	20	5.2	
Vertebrates	21	84	35.6	27.4
1. mammals	9	36	9.4	
2. birds	17	68	17.7	
3. unindentified	2	8	2.1	
Invertebrates	12	48	20.3	9.1
1. insects	7	28	7.3	
2. chelicerata	2	8	2.1	
3. larvae	5	20	5.2	
4. unindentified	4	16	4.2	
Other	4	16	6.8	3
1. garbage	3	12	3.1	
2. stones	2	8	2.1	

lus sp., *Palomena prasina,* a fragment of Hymenoptera (Vespidae) and anunidentified Arachnida. The ticks (Chelicerata) would had been the parasitic of Stone marten or even of consumed pride. To the third category belonged the probably really preys, like *Rhizotrogus aequinoctialis,* unidentified butterfly (Lepidoptera) and beetles (Coleoptera). Its number of occurrence: 2–12.

Other

The scats contained some items derive from urban garbage. There were little pieces of paper, alufolia, plastic folia of salami. Stones were of the different size. The number of occurrences in the 87 faeces were only 7. It is sure that Stone martens consume the kitchen offal. Probably they eat more than it should be calculated from results of this study, because the proportion of undigested remains is less.

Summary

Stone martens eat piggishly, quickly. While they chew extensively the bones of vertebrates, they swallow most of the plant almost at one mouthful, together with its indigestible seeds. Vegetables are important sources of carbohydrates and minerals even in the winter period (Pandolfi, De Marinis & Petrov, 1996) but probably the digestive system of Stone martens require large quantity of plants' fibres. There were different items, but the staple of diet was the vegetable food (Fig. 2). The proportion of fruits and birds are high while mammals and insects are slow on yearly average. These data diverge from the diet in natural environment, for example, the number of

occurrences was the highest of insects, then plants, mammals and birds (Lanszki, 1994). The percentage of occurrence and dry weight of garbage is low but surely the estimated volume would be higher because these items contain negligible quantity of indigestible remnants.

The damage by consuming even song-birds, some chickens is negligible comparing with causing economical damage or by storing somekinds of foods, taking faeces and urine in our close environment, etc., and spreading some diseases, parasitic. From this point of view they are pests.

But Stone martens have important trophic rule and strategy as top-predators, mainly eating and so controlling the populations of small urban vertebrates. Their versality is reflected in their euryphagy, e.g. insectivory, frugivory, folivory, necrophagy, too.

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